Thus it will be appreciated that the guide vane of the present invention provides an effective arrangement for adjusting the shape of an aifoil shell of the guide vane for tuning the vane shape for optimal performance in the face of varying flow conditions over the surface of the vane, for enhanced load balancing (and thus internal stress minimization) between the pressure and suction surfaces thereof and for enhanced response to vibrating and other transient loads.

While a preferred embodiment of the present invention is illustrated herein, it will be appreciated that various modifications thereof will suggest themselves to those skilled in the art. Thus, while the guide vane of the present invention is illustrated and described herein within the context of a mid-turbine frame engine architecture, it will be understood that the guide vane hereof may be used with equal effectiveness with any known turbine or compressor architectures. Similarly, while a specific number and placement of linkage have been illustrated, it will be understood that any quantity of linkages spaced at desired locations around the interior of the airfoil shell may be employed as determined by the range of engine operating conditions which the vane will encounter. Also, while a particular cam shape which adjusts the linkages to narrow or widen the airfoil shell, has been shown, it will be understood that any appropriate of cam shape may be employed to narrow, widen, bend, or otherwise adjust the shape of the airfoil shell. Furthermore, while the airfoil shell has been illustrated as a continuous shell, which relies on its own elasticity to change shape under the influence of the actuation of the linkages, it will be appreciated that changes in the airfoil shape may be accommodated by various other arrangements such as a multiplicity of individually movable plates, etc. Moreover, it will be understood that while the preferred linkage arrangement employs semi-rigid links as the input links in the four bar linkage, it will be understood that it may be possible to substitute rigid links in their place where transient response of the linkage and manufacturing tolerance associated therewith, permit.

Accordingly, it is understood that the claims appended hereto will cover the above-noted and other modifications, as will suggest themselves to those skilled in the art.

The invention claimed is:

1. A guide vane for a gas turbine engine said guide vane comprising:

an aerodynamic outer shell, adjustable in shape

a mechanical load bearing structural spar received within said aerodynamic outer shell and spaced therefrom by an interior gap and

at least one actuation mechanism disposed within said gap and connected to a portion of said outer shell and structural spar such that when activated, said actuation mechanism displaces said portion of said outer shell with respect to said spar thereby selectively adjusting the shape of said outer shell.

2. The guide vane of claim **1** wherein said actuation mechanism is grounded to said spar.

3. The guide vane of claim **2** wherein said actuation mechanism comprises a linkage including at least one output link pivotally connected at an outer end thereof to an inner surface of said outer shell.

4. The guide vane of claim **3** wherein said output link is grounded to said spar at an inner end thereof.

5. The guide vane of claim **4** wherein said actuation mechanism includes an input link connected at one end thereof to said output link at a medial portion thereof.

6. The guide vane of claim **5** wherein said input link is connected semi-rigidly to said output link, substantially perpendicular thereto.

7. The guide vane of claim **5** and wherein said actuation mechanism further comprises a cam disposed within said gap and a follower connected to said input link at a second end thereof and maintained in engagement with said cam such that movement of said cam causes movement of said follower and said input links thereby moving said output link to adjust the shape of said outer shell.

8. The guide vane of claim **7** wherein said cam comprises a slotted, generally cylindrical member in generally parallel disposition with respect to said spar, said slots accommodating said follower therein.

9. The guide vane of claim **5** wherein said input link is semi-rigid along the longitudinal axis thereof and a direction normal to said longitudinal axes.

10. A gas turbine engine comprising:

high pressure turbine driven by a first shaft;

a low pressure turbine driven by a second shaft,

a working medium fluid flowing between said high and low pressure turbines through a gas path,

said first and second shafts being mounted on a frame intermediate said low and high pressure turbines,

the mechanical load of said frame being transmitted at least in part to an engine mount by a mechanical load bearing guide vane;

said guide vane including an outer aerodynamic shell, the outer shape of said guide vane being adjustable to accommodate varying operating parameters of said engine, to counteract thermal distortion thereof and to effect aerodynamic load balancing.

11. The gas turbine engine of claim **10** said guide further including:

a mechanical load carrying structural spar received within said aerodynamic outer shell and spaced therefrom by an interior gap and

at least one actuation mechanism disposed within said gap and connected to a portion of said outer shell and structural spar such that when activated, said actuation displaces said portion of said outer shell with respect to said spar thereby selectively adjusting the shape of said outer shell.

12. The gas turbine engine of claim **11** wherein said actuation mechanism is grounded to said spar.

13. The gas turbine engine of claim **11** wherein said actuation mechanism comprises a linkage including at least one output link pivotally connected at an outer end thereof to an inner surface of said outer shell.

14. The gas turbine engine of claim **13** wherein said output link is grounded to said spar at an inner end thereof.

15. The gas turbine engine of claim **11** wherein said actuation mechanism includes an input link connected at one end thereof to said output link at a medial portion thereof.

16. The gas turbine engine of claim **15** wherein said actuator further includes a cam disposed within said gap and a follower connected to said input link at a second end thereof and maintained in engagement with said cam such that movement of said cam causes movement of said follower and said input link, thereby moving said output link to adjust the shape of said outer shell.

17. The gas turbine engine of claim **16** wherein said cam comprises a slotted, generally cylindrical rod in generally parallel disposition with respect to said spar, said slots accommodating said follower therein.

18. The gas turbine engine of claim **15** wherein said input link is semi-rigid in a direction generally parallel to the longitudinal axis thereof.

* * * * *